

DE-FOA-0002162: Request for Information (RFI) on “DRAFT Research and Development Opportunities Report for Opaque Building Envelopes”

DATE: June 1, 2020
SUBJECT: Request for Information (RFI)

Description

The United States (U.S.) Department of Energy (DOE) Building Technologies Office (BTO) is seeking input from the public about its [DRAFT Research and Development Opportunities \(RDO\) Report for Opaque Building Envelopes](#). The draft RDO report identifies current envelope characteristics, research and development (R&D) opportunities, integration approaches and implementation pathways for high-performance envelope technologies. BTO is requesting feedback on each of these areas, as well as planned technical objectives, metrics and targets, and overall R&D activities and their prioritization.

Background

In 2019, buildings accounted for 39.2% of total U.S. primary energy use, with electricity use accounting for 71.1% of building primary energy use. The building envelope—the barrier that helps maintain comfortable indoor conditions regardless of prevailing outdoor conditions—is the single largest contributor to primary energy use in residential and commercial buildings. The “opaque” envelope, which comprises all elements of the building envelope besides windows (such as walls, roofs, and foundations), affects 25% of building energy use, or 10% of total U.S. primary energy use. Novel opaque envelope technologies could dramatically reduce this building energy while simultaneously delivering additional benefits—comfort, well-being, and productivity—for building owners and occupants.

The U.S. Department of Energy (DOE) Building Technologies Office (BTO) Emerging Technologies (ET) program supports R&D for technologies, systems, and software tools that can contribute to reductions in building energy use. ET funding is distributed competitively through solicitations (i.e., Funding Opportunity Announcements), which generally are open to applications from industry, academia, national laboratories, and other entities. The RDO report focuses on R&D for opaque envelope technologies and provides guidance for BTO’s investments in developing the next generation of high-performance, affordable, cost-competitive opaque envelope technologies in partnership with industry and researchers. Furthermore, the RDO report addresses areas for DOE investment in software tools that translate sophisticated and complex physics into easy-to-use energy performance and optimization methods used by industry and other stakeholders for implementation activities that go beyond DOE’s direct area of responsibility.

This is a Request for Information (RFI) only. EERE will not pay for information provided under this RFI and no project will be supported as a result of this RFI. This RFI is not accepting applications for financial assistance or financial incentives. EERE may or may not issue a Funding Opportunity Announcement (FOA) based on consideration of the input received from this RFI.

The Opaque Envelope R&D subprogram seeks to develop next-generation envelope technologies that have substantial potential to cost-effectively reduce primary energy consumption, and improve demand flexibility and occupant comfort. The draft RDO report identifies *passive, static* and *active, dynamic* technologies that have the greatest potential to transform opaque envelope performance in new and existing buildings. Active, dynamic thermal technologies, a new research opportunity area, have the ability to increase the building capacity to modify demand and therefore benefit the electric grid, while also improving the overall energy efficiency of the building. To help inform the building research community, BTO has published a series of technical reports that discuss its Grid-interactive Efficient Buildings (GEB) strategy. [The Windows and Opaque Envelope GEB report](#) details the technology opportunities specifically relevant to providing demand-side flexibility with windows and opaque envelope technologies. The GEB technical report complements the RDO Report for Opaque Building Envelopes.

Purpose

The purpose of this RFI is to solicit feedback from the public on the RDO report prior to its final publication later in 2020. BTO will not develop a FY20 Funding Opportunity Announcement (FOA) based on the feedback from this RFI. This RFI includes guidance on how to provide feedback that will inform updates to the RDO report itself, and ultimately, the strategic direction of the portfolio moving forward. This is solely a request for information and not a Funding Opportunity Announcement (FOA). EERE is not accepting applications.

Disclaimer and Important Notes

This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

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Proprietary Information

Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [List Applicable Pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0002162. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure” and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

Evaluation and Administration by Federal and Non-Federal Personnel

Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

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Request for Information Categories and Questions

Category 1: Envelope Overview

- (1) Has BTO accurately characterized current typical and state-of-the-art technologies, as well as the challenges and barriers that exist to the adoption of high-performance opaque envelopes? If not, what specific characterizations need to be improved and in what way?

Category 2A: Research Opportunity Areas—Passive and Enabling Technologies

Passive envelope technologies and enabling technologies are discussed in Sections 3.1–3.3 in the RDO report. These technologies include both traditional envelope efficiency technologies related to air sealing and insulation, as well as enabling technologies like diagnostics and modeling software.

- (2) Are there any research opportunity areas for passive opaque envelope technologies and enabling technologies that are not adequately described? If so, please identify the technology areas or technologies within a particular area that require further description, or that should be added.
- (3) Are there any R&D barriers for the passive and enabling technologies discussed that are missing or have not been sufficiently addressed? If so, please describe.
- (4) Envelope diagnostic technologies can help quantify the performance of an envelope assembly in situ. Qualitatively, these technologies must be fast, inexpensive, not disrupt occupants' comfort or activities, provide the extent of defects and their locations, and ideally operate on fully or partially complete facades and in all ambient weather conditions.
 - a. What are suitable metrics to define the effectiveness and market acceptability of these technologies? These metrics could include test cost (\$/test or \$/ft² floor area) and test time inclusive of setup and teardown (sec/ft²), among others.
 - b. What targets would represent stretch goals beyond the current state-of-the-art that would help accelerate the adoption of and improve the benefits derived from envelope diagnostic technologies? For target values, please provide any available supporting references or sources.
- (5) Envelope remediation technologies seek to effectively increase building envelope performance with minimum disruption to building occupants. This includes novel insulation delivery systems and air sealing technologies.
 - a. What are suitable metrics to define the effectiveness and market acceptability, particularly for insulation delivery and defect mitigation systems?

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- b. What targets would represent stretch goals that would help accelerate the adoption of and improve the benefits derived from novel envelope remediation technologies, particularly for insulation delivery and mitigation systems? For target values, please provide any available supporting references or sources.
- c. Are there any advancements from other sectors not considered in the RDO report, such as utilizing robotics in remediation platforms that need to be included in the discussion or captured in the assumptions made in terms of technology development, performance or price targets, and energy savings goals?

Category 2B: Research Opportunity Areas—Active, Dynamic Technologies

Active, dynamic opaque envelope technologies are discussed in Sections 3.4–3.6 in the RDO report. These technologies incorporate heat and/or mass transfer properties that can be varied in a controlled way. These capabilities have the potential to further reduce energy use and could allow the building envelope to support demand flexibility.

- (6) Are there specific active, dynamic technologies missing from the RDO report? If so, what specific technologies are absent and how would they contribute to demand flexibility? Please provide supporting information with your answers.
- (7) Are there any R&D barriers for the active, dynamic technologies discussed that are missing or have not been sufficiently addressed? If so, please describe.
- (8) Thermal and moisture storage integrated into the building envelope can shift the timing of heating and cooling energy demand, improve thermal comfort by stabilizing indoor temperatures, and offset energy use by taking advantage of favorable ambient conditions. Moisture storage technologies could further provide independent latent heat control. Metrics and corresponding targets are needed to quantify the performance and market price of these technologies.¹
 - a. What are appropriate key metrics for defining the performance of thermal and moisture storage technologies integrated into the building envelope? How would metrics for thermal storage technologies differ from those used with moisture storage technologies?
 - b. What quantitative targets would be appropriate as stretch goals? How would stretch goals for thermal storage technologies differ from those for moisture storage technologies? For target values, please provide any available supporting references or sources.

¹ For thermal storage, relevant metrics include cost or price (\$/kWh), specific energy (Wh/kg), energy density (Wh/L), specific power (W/kg), power density (W/L), usable energy at specified C-rate (kWh), charge requirements (X% Δ SOC in N hours), and self-discharge (%/day), all on a thermal basis.

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- (9) How should BTO divide its resources, on a percentage basis, between the development of passive and active opaque envelope technologies? Please provide supporting background for the allocation percentages chosen.

Category 3: Technical Targets

Technical targets for installed prices and performance are developed for each of the technology areas and are shown in Tables 3-1, 3-2, 3-3, and 3-4 in the RDO report. Details regarding the model formulation and assumptions can be found in Appendix A of the RDO report.

- (10) Is the method and payback period used to develop the installed price targets reasonable? If not, please suggest an alternative methodology and payback period.
- (11) Are the 2040 targets appropriate, keeping in mind that they are intended to be stretch goals? If not, which specific targets do not appear achievable? Please suggest alternative targets and provide supporting justification for their market-acceptability.
- (12) Are intermediate targets for 2030 needed to guide R&D activities? If so, are they needed for all technology areas, or are they particularly needed for some technologies?

Category 4: Integration

- (13) Technologies developed for other applications—such as computer vision, robotics, and drones—have the potential to improve the performance of building envelopes and retrofits while reducing their cost. This approach is the primary thrust of BTO's Advanced Building Construction initiative. Do the approaches presented sufficiently capture the additional pathways to enabling and accelerating high-performance envelope adoption? If not, please describe the additional approaches or pathways that should be added to the discussion. Are any energy or non-energy benefits missing? If so, please identify the specific benefits that are not sufficiently articulated. If possible, provide quantitative data and/or references that include information on these benefits.
- (14) Holistic (systems-level) building design can lead to greater investment in high-performance opaque envelope technologies by reducing HVAC capacities and the extent of HVAC distribution systems, thus reducing capital costs while increasing comfort. What opaque envelope R&D activities can encourage holistic design and retrofit? For residential and commercial renovation, are there BTO technical activities that could encourage major upgrades that incorporate full envelope upgrades?

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Category 5: Implementation

- (15) Beyond technology price and performance, other factors can influence the adoption of high-performance envelope technologies, including market barriers related to knowledge and expertise, financing, and intrinsic technology properties. These barriers can be addressed by a variety of actions from a wide range of stakeholders. Has the report adequately captured the implementation factors and market adoption barriers that can influence adoption of advanced envelope technologies? If not, what other implementation strategies and barriers are important to include? Please identify and explain.

Category 6: Other Feedback

- (16) Please provide any other feedback on the RDO report.

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to BTO_Envelope_RDO@ee.doe.gov no later than 5:00pm (ET) on July 20, 2020. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than 10 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or topic if applicable. Within the report, topics, barriers, and initiatives are numbered with section and subsection heading numbers. In your response, please include these numbers in your responses. Respondents may answer as many or as few questions as they wish.

BTO will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Institution name and website
- Institution type (e.g., university, utility, nonprofit organization, small business, etc.)
- Stakeholder type (e.g., researcher, manufacturer, advocacy group)
- Institution contact name and email address.

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